

11.—Harris Sandstone-Yindagindy Formation relationships and possible position of permo-carboniferous boundary, Carnarvon Basin, Western Australia

by J. F. Read¹, P. J. Alcock² and P. Hoseman³

Manuscript received 18 July 1972; accepted 19 September 1972

Abstract

This paper describes the stratigraphic relationships between plant-bearing sediments of possible Carboniferous or Permian age and underlying Yindagindy Formation sediments (Lower Carboniferous) exposed in the eastern Carnarvon Basin. The sequence is, in descending order:

3. Lyons Group (Permian),
2. Harris Sandstone, and
1. Yindagindy Formation (Lower Carboniferous).

In the Moogooree area, plant-bearing sandstones previously included in the Harris Sandstone have been assigned to the Lyons Group by White and Condon (1959). The main reasons for the change were that the plant-bearing beds differed lithologically from the Harris Sandstone, and rested with erosional unconformity on a surface of marked relief. Detailed mapping in the Moogooree area indicates that these plant-bearing beds are similar lithologically to the Harris Sandstone and that they are mildly disconformable upon the Yindagindy Formation. An angular unconformity which separates the Permian, Lyons Group from the underlying Harris Sandstone probably represents the Carboniferous-Permian boundary in the area.

Introduction

This paper describes the stratigraphic relationships between plant-bearing beds of Carboniferous or Permian age and the underlying Lower Carboniferous Yindagindy Formation in the Moogooree area, eastern Carnarvon Basin, Western Australia (Fig. 1).

The "Yindagindi limestone" of Teichert (1950) was renamed Yindagindy Formation by Condon (1954), who considered it to be of Carboniferous age because of its conformable relationship with underlying Carboniferous beds.

Overlying plant-bearing sandstones in the Moogooree area were informally named the "Red Hill sandstone", by Teichert (1950). Condon (1954, p.31) renamed the plant-bearing beds the Harris Sandstone, making the type section approximately 31 km. (19 mi.) north-north west of Moogooree Homestead; at the type section, the Harris Sandstone was considered to conformably underlie the Lyons Group and to disconformably overlie the Yindagindy Formation. Condon (1954, p.34) excluded the Harris Sandstone from the Lyons Group because of lithologic and genetic differences.

Later, the plant-bearing sandstones around Moogooree were included in the Lyons Group as they were considered to be lithologically similar to non-tillitic parts of the Lyons Group and differed lithologically from the Harris Sandstone at the type section (White and Condon 1959, p.58; Condon 1967, p.7). This implied that the Harris Sandstone was absent from the section exposed at Moogooree. Furthermore, Condon (*in* White and Condon 1959, p.58) considered that the plant-bearing beds in the Moogooree area rested unconformably on an erosional surface of marked relief developed on Yindagindy Formation sediments.

In contrast, Dickins and Thomas (1959) considered that the plant-bearing sandstones around Moogooree were equivalent to the Harris Sandstone at its type section as the rocks formed a distinct stratigraphic unit on the basis of lithology, field occurrence and stratigraphic position and that they are distinguishable from the Lyons Group in that they are non-tillitic. In this paper, these plant-bearing sandstones will be referred to as Harris Sandstone.

The Yindagindy Formation is considered to be of Lower Carboniferous age by Thomas (1962). Dickins and Thomas (1959) assign a Lower Permian age to the Lyons Group. However, the age of the Harris Sandstone is at present inconclusive; White (*in* White and Condon 1959) considers that the lepidodendroid plant material could be of Carboniferous or Permian age but Krausel (1961) implies that it is Carboniferous.

Stratigraphy

Determination of contact relationships between the Lower Carboniferous Yindagindy Formation and the Carboniferous or Permian Harris Sandstone around Moogooree has been hindered by faulting, by poor exposure of Yindagindy Formation-Harris Sandstone contact and Harris Sandstone-Lyons Group contact and by the absence of adequate fossil material for determining age of the Harris Sandstone and basal Lyons Group beds.

The Yindagindy Formation-Harris Sandstone contact at localities 1 to 4 (Fig. 1) was mapped by plane table at a scale of 1:1200; a traverse was run at locality 5. To facilitate mapping, the Yindagindy Formation was divided into 4 units. The sequence in the Moogooree area is, in descending order:

Harris Sandstone:

Thickness at type section, 85 metres (Condon 1967, p. 11).

In the Moogooree area the Harris Sandstone occurs in fault-blocks which form low red hills; local total

¹Department of Geology, University of Western Australia, Nedlands, Western Australia, 6009.

Present address: Dept. of Geological Sciences, Virginia Polytechnic and State University, Blacksburg, Virginia, U.S.A.

²Placer Prospecting (Aust.) Pty. Ltd., Box 4315, G.P.O., Sydney, 2001.

³West Australian Petroleum Pty. Ltd., Perth, Western Australia, 6000.

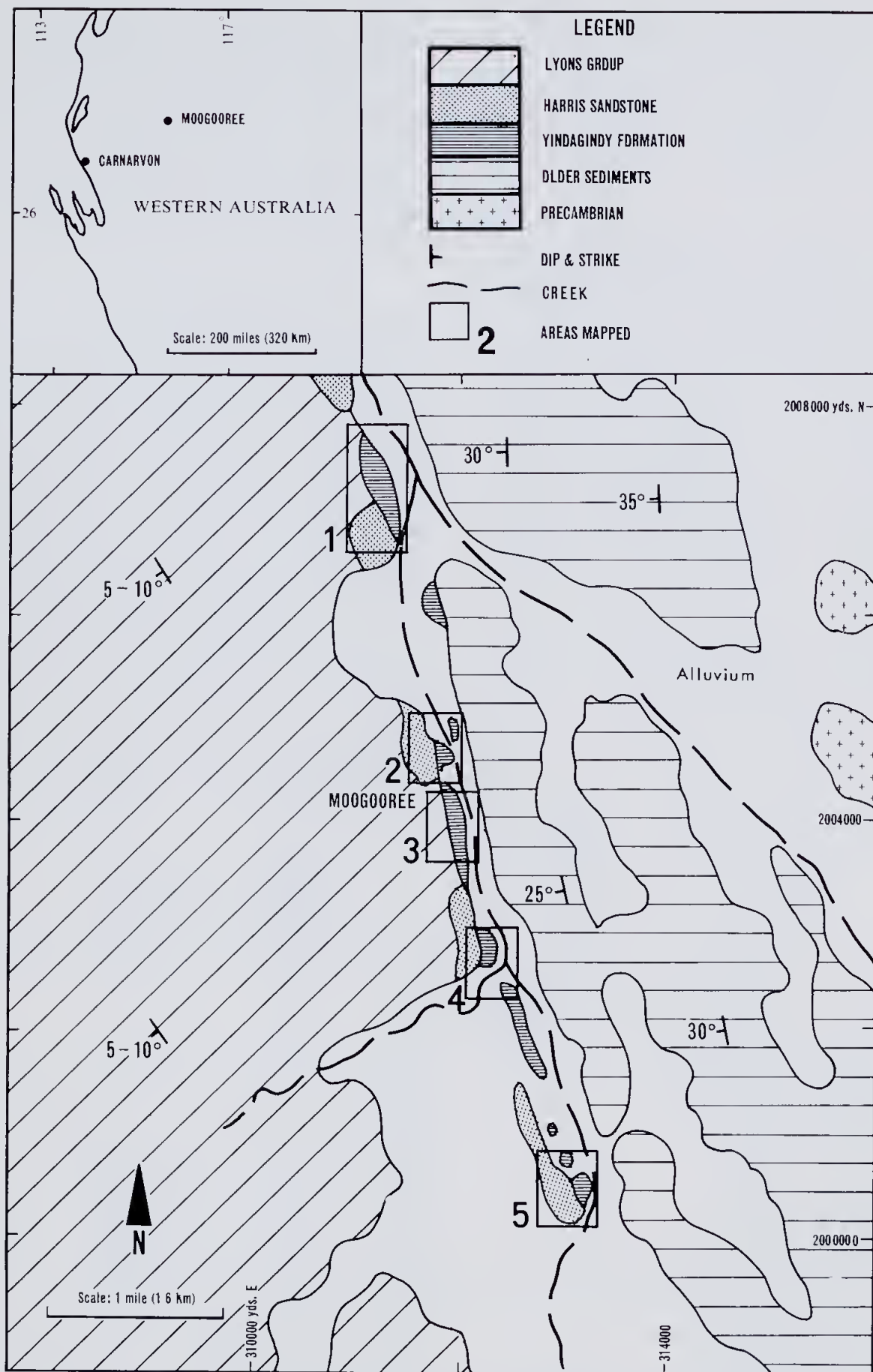


Figure 1.—Locality map and general geology of the Moogooree area: adapted from photogeological map supplied by West Australian Petroleum Pty. Ltd.

thickness of the unit is not known. Contacts between the Harris Sandstone and the overlying Lyons Group are concealed beneath a residual cover of pebbles and boulders from glacial beds of the Lyons Group, together with siliceous laterite fragments. The Harris Sandstone consists of thinly bedded or cross-bedded, well-sorted, medium- to coarse-grained quartz sandstones; the sandstones are clean and free of detrital matrix¹. Cortical impressions and casts of lepidodendroid stems are common near the base of the formation. The Harris Sandstone disconformably overlies.

Yindagindy Formation:

Maximum thickness in the Moogooree area, 68 metres.

Unit D.—(20 metres). This unit consists of fine-grained lime mudstones and interbedded, poorly exposed terrigenous sediments. The lime mudstones are laminated and have birdseye structures; they are poorly fossiliferous. The uppermost beds of the Yindagindy Formation are poorly exposed, thin ferruginous quartz sandstones (2 metres thick) and an underlying blue vuggy limestone which forms a distinctive marker bed. The blue vuggy limestone is characterized by abundant subvertical tubes up to 1 cm in diameter which are filled with sparry calcite. Locally where the quartz sandstone has been eroded, the blue, vuggy limestone marks the top of the formation. At locality 1, a limestone pebble conglomerate appears to be laterally equivalent to or overlies the blue, vuggy limestone bed.

Unit C.—(38 metres). This unit crops out as a low strike ridge. The unit consists of poor-sorted, medium- to coarse-grained calcareous feldspathic sandstones which are locally cross-bedded, together with poorly exposed siltstones and claystones, and intercalated oolitic limestones. Rare fossils include brachiopods, gastropods, serpulids and algal structures.

UNIT B.—(4.5 metres). This unit crops out as a bluff. It consists of brown, thick-bedded, quartzose

skeletal-fragment limestones and minor oolitic and coquinoid limestones. Fossils include brachiopods, crinoids and bryozoans.

UNIT A.—(5.5 metres). This unit is generally obscured by a rubble slope flanking the bluff formed by unit B limestones. It consists of fine- to coarse-grained, thin-bedded or cross-bedded, poor-sorted calcareous feldspathic sandstones with two limestone horizons, the lower one marking the base of the Yindagindy Formation; it conformably overlies.

Williambury Formation:

Thickness at the type section, 235 metres (Condon 1967, p.69).

Friable, poorly sorted, medium- to coarse-grained feldspathic sandstone.

Harris Sandstone—Yindagindy Formation Contact

Contacts between the Harris Sandstone and Yindagindy Formation are typically faulted, and the abundance of faults suggest that the area lies within a fault zone. The faults are evidenced by stratigraphic discrepancy where upper beds of the Yindagindy Formation or lower parts of the Harris Sandstone are missing. Other features associated with the faults are slickensides in sandstones of the Harris Sandstone and Yindagindy Formation, calcite veins in limestones and folding of limestone beds. Relative movement on faults is generally west-block down with variable lateral displacement.

Stratigraphic relationships between the formations were determined where sedimentary contacts have not been obscured by faulting. Such contacts occur in the southern portion of locality 1, in a fault block at locality 2, at the southern end of locality 4 and at locality 5. The stratigraphic succession and probable thickness

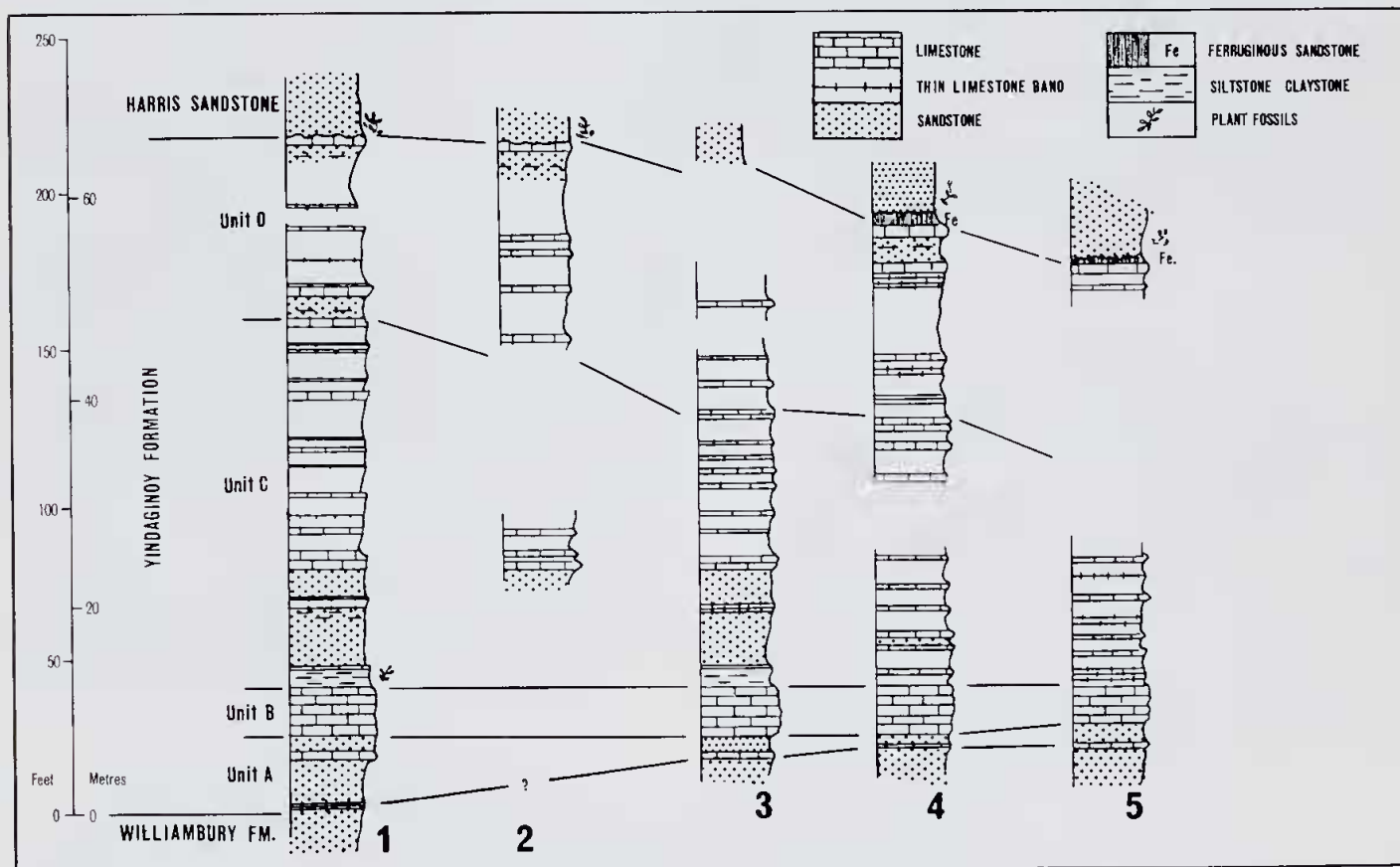


Figure 2.—Columnar sections of the Yindagindy Formation, Moogooree area, localities 1 to 5. Blank pattern denotes soil covered areas.

of the Yindagindy Formation at each locality are shown in Figure 2. Detailed maps of localities 1 to 4 are shown in figs. 3 and 4.

Locality 1.—The Harris Sandstone at the southern end of locality 1 rests on blue, vuggy limestone and contains abundant cortical impressions of lepidodendroid stems. Locally, a limestone-pebble conglomerate (up to 1 metre thick) underlies the Harris Sandstone; the conglomerate is probably stratigraphically equivalent to the blue, vuggy limestone. Dips of the Harris Sandstone, and Yindagindy Formation at the contact are flat-lying; dips are unreliable in determining stratigraphic relationships as some beds are displaced by faults.

Locality 2.—The Harris Sandstone occurs as low residual mounds up to 3 metres high in a fault block in the central portion of locality 2.

It contains plant fossils and rests upon the blue, vuggy limestone. The contact is well exposed and the sediments are almost horizontal. West of this fault block unit D is exposed as west dipping limestone bands, the topmost band being blue, vuggy limestone. West of this bed the Harris Sandstone crops out as rubble in soil.

Locality 3.—The sequence at locality 3 is heavily faulted and formation contacts are concealed beneath soil. A thick section of Yindagindy Formation is exposed at this locality (Fig. 2).

Locality 4.—Contacts are well exposed in and south of a north-east flowing creek in the central portion of locality 4. Here, plant-bearing sandstones rest upon 2 metres of ferruginous, non-fossiliferous quartz sandstone which overlies blue, vuggy limestone. Limestones of unit D are well exposed at this locality. Dips of 20 to 25 degrees above and below the contact suggest conformable or disconformable contacts.

Locality 5.—At locality 5, plant-bearing beds overlie thin ferruginous, non-fossiliferous sandstones which rest on blue, vuggy limestone.

Lithological correlations of Yindagindy Formation limestones of unit D indicate that the blue, vuggy limestone is the same stratigraphic horizon in all areas mapped.

Conclusions

In the Moogooree area, the Harris Sandstone disconformably overlies a thin (2 metres) ferruginous sandstone or (where this has been eroded), a distinctive, blue, vuggy limestone horizon. The ferruginous sandstone and underlying blue, vuggy limestone are the uppermost beds of the Yindagindy Formation in the area. Locally, a limestone-pebble conglomerate (up to 1 metre thick) which is closely associated with blue, vuggy limestone, lies at the top of the Yindagindy Formation.

The ferruginised top of the Yindagindy Formation and the sharp change in lithology from the Yindagindy Formation to the Harris Sandstone indicate a disconformity (Condon 1954, p.30). However, in the Moogooree area,

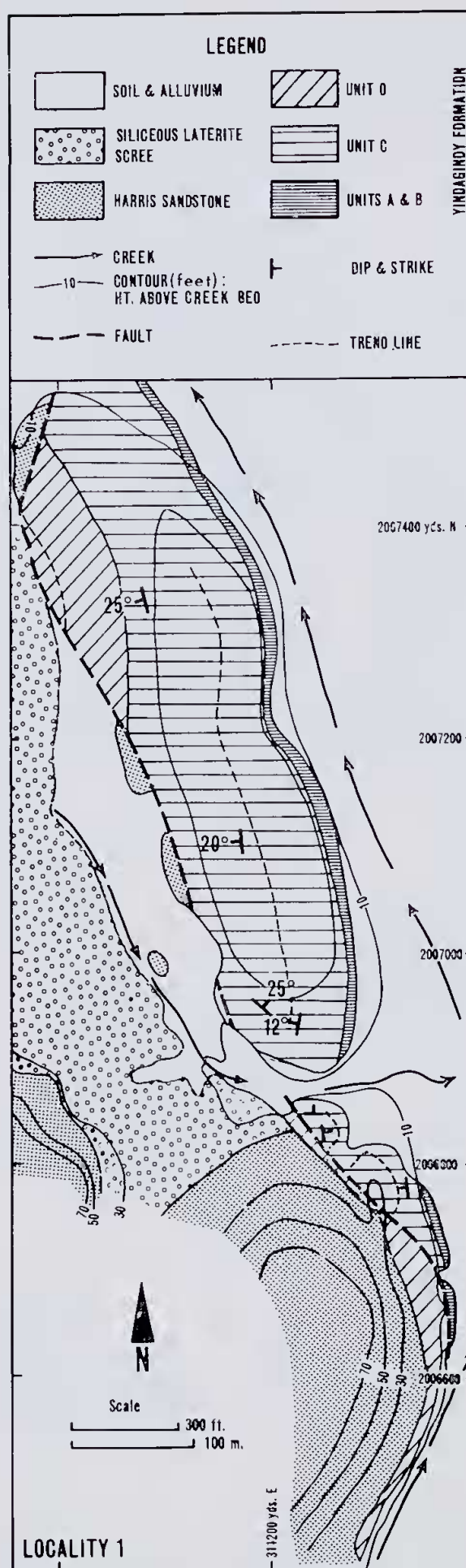


Figure 3.—Geological map, locality 1.

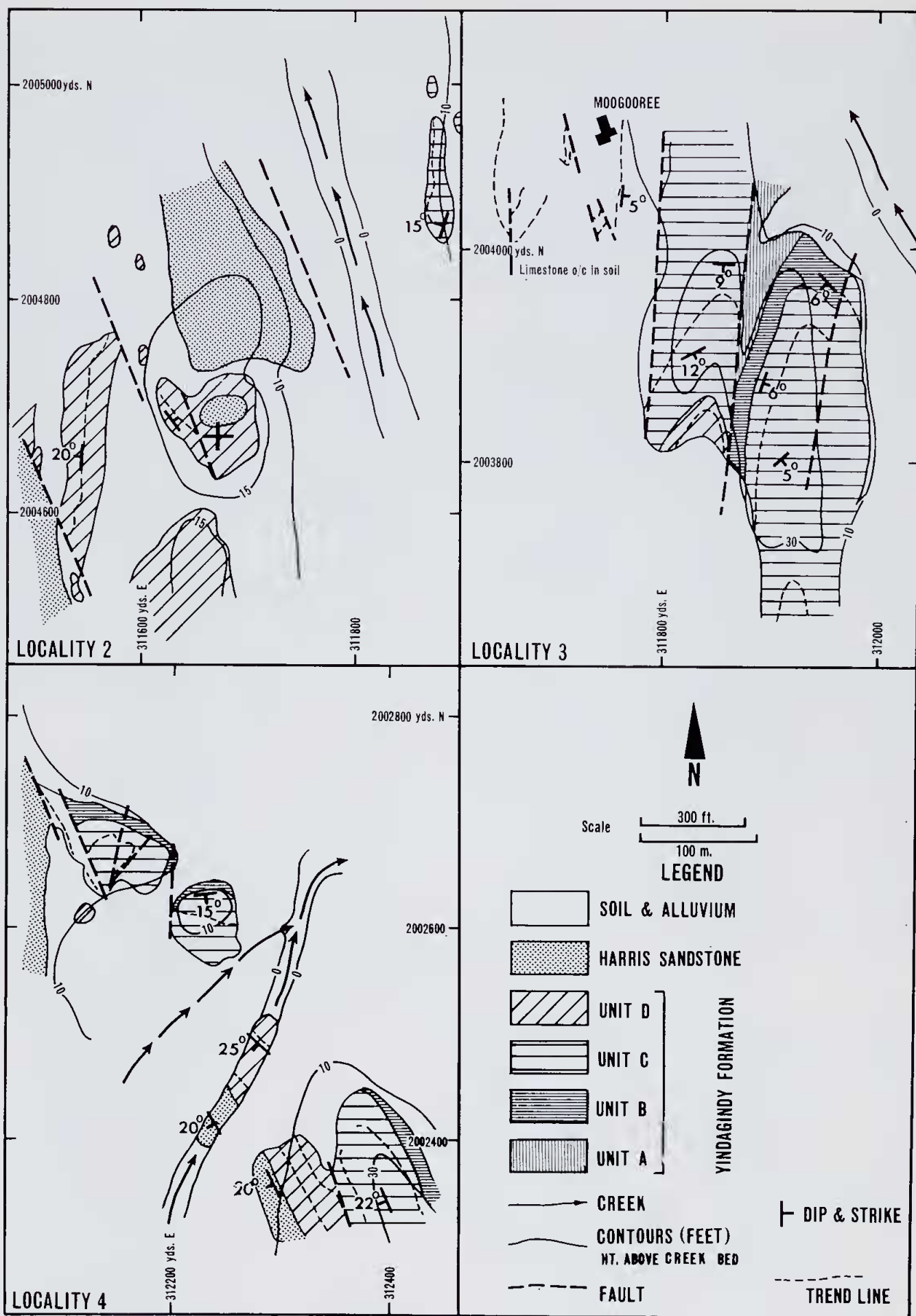


Figure 4.—Geological maps, localities 2, 3 and 4.

the disconformity surface has little relief, probably 2 metres maximum, and is essentially parallel to the underlying Yindagindy Formation beds. There is no evidence for an erosional unconformity of *marked relief* at the base of the plant-bearing sandstones as reported by Condon (*in* White and Condon 1959). Removal of parts of the Yindagindy Formation and Harris Sandstone by later faulting has brought Harris Sandstone or Lyons Group sediments into contact with a truncated sequence of the Yindagindy Formation, simulating an erosional contact of high relief. Lithologically, the sandstones are similar to the Harris Sandstone at the type section, being clean quartz sandstones rather than silty quartz greywackes as reported by White and Condon (1959, p.58). Thus the plant-bearing beds are referred to the Harris Sandstone and not the Lyons Group as White and Condon (1959) and Condon (1962) proposed.

South of Moogooree homestead, the Lyons Group progressively truncates older sediments till it finally rests upon the Precambrian basement rocks (Condon 1962). As the Harris Sandstone is concordant with the underlying Yindagindy Formation, an angular unconformity probably exists between Harris Sandstone and overlying Lyons Group, instead of the conformable contact of Condon (1954). The contact between the Harris Sandstone (Carboniferous?, Krausel 1961) and the Lower Permian, Lyons Group (Dickins and Thomas 1959) may mark the Carboniferous-Permian boundary in the region.

Acknowledgements.—This paper is part of a joint honours thesis submitted to the Department of Geology, University of Western Australia in 1966. Field work was funded by The University of Western Australia and a grant from West Australian Petroleum Pty. Ltd. The project was supervised by B. W. Logan; thanks are also due to J. J. E. Glover, P. J. Coleman and B. E. Balme of the Geology Department, The University of Western Australia. M. H. Johnstone, of West Australian Petroleum Pty. Ltd. introduced the authors to the area. Figures were prepared by C. Hughes and C. Bell.

References

- Condon, M. A. (1954).—Progress report on the stratigraphy and structure of the Carnarvon Basin, Western Australia. *Bur. Min. Resour. Aust. Rep.* 15.
- Condon, M. A. (1962).—Kennedy Range, W.A.—1:250,000 Geological Series. *Bur. Min. Resour. Aust. Explan. Notes.* 28 pp.
- Condon, M. A. (1967).—The geology of the Carnarvon Basin, Western Australia. Pt. 2: Permian Stratigraphy. *Bur. Min. Resour. Aust. Bull.* 77.
- Dickins, J. M. and Thomas, G. A. (1959).—The marine fauna of the Lyons Group and the Carandibby Formation of the Carnarvon Basin, Western Australia. *Bur. Min. Resour. Aust. Rep.* 38: 65-96.
- Krausel, R. (1961).—*Lycopodiopsis derbyi* Renault und einige andere Lycopodiales aus den Gondwana-Schichten. *Palaeontographica*, Abt. B, 109 (1-4): 62-92.
- Teichert, C. (1950).—Some recent additions to the stratigraphy of Western Australia. *Bull. Amer. Ass. Petrol. Geol.* 34 (9): 1787-1794.
- Thomas, G. A. (1962).—The Carboniferous stratigraphy of Western Australia. *G.R. 4^{ème} Congr. Strat. Geol. Carb.* (Heerlen, 1958) T III: 733-740.
- White, Mary E. and Condon, M. A. (1959).—A species of *Lepidodendron* from the basal Lyons Group, Carnarvon Basin, Western Australia. *Bur. Min. Resour. Aust. Rep.* 38: 55-64.